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PROSPECTING METHODS ON GROUNDWATER IN LESS DEVELOPED AREAS, NEW WORKING METHODS AND THEIR APPLICATION

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Prospecting Methods on Groundwater in Less Developed Areas.

New Working Methods and Their Application.

by
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Groundwater prospection is an important problem of Technical Assistance in less developed countries.

The base for technical prospection, such as the sinking of boreholes, are hydrogeological, incl. geophysical, investigations in the field; also the runoff is to be considered. Extensive operations done by the BUNDESANSTALT FÜR BODENFORSCHUNG in less developed countries in the Mediterranean, the Near-, Middle- and Far East, in Central- and North Africa and in South America, viz. under arid, semi-arid, humid and tropic climatic conditions, have shown the suitability of groundwater investigation teams to be set to work in such regions; with a minimum in personnel and equipment, such teams are in the position to obtain a maximum in results, with relatively little expenditure of time, on account of their outfit with most modern means and methods. The smallest unit of such a team consists of one hydrogeologist, one geophysicist and one engineer; additionally there would be a soil scientist, if the prospection aims also at irrigation purposes.

Such a team is equipped, in particular, with a chemical field laboratory and with apparatus for the performance of geophysical investigations. This outfit, constructed chiefly on the principles of own develop-

ments in the BUNDESANSTALT FÜR BODENFORSCHUNG, is adapted to every kind of climatic conditions; it can be used reliably also in tropical regions. The small dimension of the equipment makes possible its transport also by air into the region of operation.

The chemical field laboratory will furnish the hydrogeologist with analyses already during reconnaissance and thus will provide him with indications useful in projecting his field work. Hardness, pH- and chlorine content in waters can be determined.

In geophysical techniques geoelectrical resistivity measurements on the soil surface according to the "Four-Point-Method" are well to the fore. This method mediates a concept about the sequence of strata in the underground down to several hundred meters. A fully transistorized tropicalized highly sensitive instrument, developed for this particular purpose - smallest voltages less than 10^{-5} Volt can be measured in the field - has proved its value in an excellent way in all previous enterprizes. Results obtained so far proveded in all cases valuable conclusions on the geological structure of the underground in general, the distribution of aquifers and impermeable beds, and the course of the fresh/saltwater interface in regions where, according to geological conditions, saltwater is expected. Geoelectrical techniques are an auxiliary means to be employed with relatively little expenditure in the endeavour to get a picture, both large-scaled and local, about useable groundwater resources even in greater depths.

So for instance, in 1959, freshwater sources were encountered by this method in the Chaco Boreal of Paraguay. Moreover, a wide-spaced reconnaissance survey furnished a conception on the total groundwater balance of this region. In the Ganges Plain of East Pakistan, 1960, water-bearing sands could be delimitated against clayey/loamy impermeable

sediments. This was the base for initiating 300 water drillings. In 1961, a hydrogeological team operated in Indonesia. Here, geoelectrical techniques were applied in a karstic region in Central Java, and for groundwater development in limestones on the Isle of Madura.

An instrument constructed for seismic refraction measurements without using explosives was tested by a team who, in 1962, carried out groundwater investigations in the Damascus Basin in Syria.

Examinations for employing geothermal methods, which naturally are applicable only in areas with appropriate climatic conditions, have also been initiated. Good results are to be expected especially in karstic regions.

The results of large-scaled surveys have been documented in hydrogeological maps. As an example may be pointed out the Hydrogeological Index Map 1 : 250.000, of the Isle of Madura (Indonesia) which for the first time had been submitted on the occasion of the ECAFE Seminar Bangkok, 1962, by the BUNDESANSTALT FÜR BODENFORSCHUNG in cooperation with the Geological Survey of Indonesia. This map represents the basic material for developing waterprospective areas.

In prospecting for irrigation it was found useful to combine hydrogeological basic work with adequate soil scientific investigations and to supplement the team by a soil scientist as this has been done in Paraguay in 1959, and in Egypt in 1960.

Counterparts in the less developed countries have proved to be a considerable help in all work. Whilst the counterpart scientists contribute towards the understanding of their country, in all essential respects, the scientists of the team mediate the present state of science in the country rendering the "Technical Assistance".

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